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(54) **Method and apparatus for forming an elevated concrete slab section of a building.**

(57) The method includes assembling a supporting structure (10) at a predetermined level and laying a plurality of elongated forming members (14) of substentielly rectangular cross section across the supporting structure in parallel spaced apart relationship. The forming members (14) have a pair of outwardly projecting shelves one on each of two opposite sides along the entire length of the member. By laying beam plates (20) on the shelves a beam channel (38) is formed by the opposed sides (40, 42) of adjacent forming members (14) and the top surface of the beam plete (20). Speces between forming members (14) which do not define beam channels are covered by laying elongated bridging plates (22) on the tops of the adjacent spaced apart forming members, the combination of the top surfaces of the forming members (14), the beam channels (38) and the top surfaces of the bridging plates (22) provides the form for a bottom surface of a concrete slab section. Levelling of concrete poured over the combination results in a slab surface having a thin layer of concrete between spaced apart thickened beam portions. Forming the concrete slab in this way reduced the required emount of concrete and hence the weight of the slab.

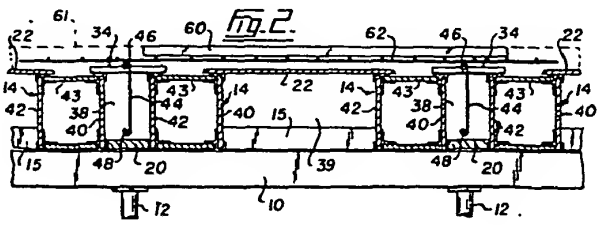

Fig. 2

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"METHOD AND APPARATUS FOR FORMING AN ELEVATED CONCRETE SLAB SECTION OF A BUILDING"

The present invention relates to a method and apparatus for forming an elevated concrete slab of a building.

Known methods of constructing concrete slabs of buildings utilize movable forms which extend from a lower slab up to substantially the bottom surface of a slab section to be formed. The top surfaces of these forms are generally flat. A typical pour of concrete with such forms includes a level generally 8" layer of concrete with reinforcing rods laid throughout. Following completion of the pour and setting of the concrete, the form is collapsed slightly and rolled out from under the freshly poured slab section where it is moved by an overhead crane to a new location where the process is repeated. Considering the size of equipment required to move such forms and the size of the forms themselves such forms have been useful only for relatively large construction projects. Moreover, because of the high cost of labour it has not been hitherto economical to form a concrete slabs with a relatively thin layer of concrete supported at regular intervals by thicker parallel spaced apart concrete beams integral with the thin layer of concrete.

The present invention provides a method of forming an elevated concrete slab of a building which includes assembling the supporting structure at a predetermined

distance below desired level of the slab section. The method includes laying a plurality of elongated forming members of substantially rectangular cross section in parallel spaced apart relationship on top of the supporting structure. The ends of the members extend between transversely extending forms which are for forming a concrete end structure to be made integral the slab which is used to support the ends of the slab section. Each of the forming members have protruding shelves along its sides parallel to the bottom surface of the forming member. Laying an elongated beam plate on opposed shelves between preselected ones of said forming members results in a beam channel defined by the upper surface of the plate and the opposed sides of th forming members. By laying elongated bridging plates over the tops of those spaces between spaced apart forming members which are not beam channels a continuous form for the bottom surface of the concrete slab section is provided by the upper surfaces of the bridging plates and forming members in combination with the beam channels. Pouring concrete over the combination of forming members, bridging plates and beam plates to a preselected level above the tops of the forming members and levelling the top surface of the concrete results in a completed elevated slab section.

Advantageously, the method further comprises placing gapping means for spacing the ends of the elongated

forming members and the concrete end supporting structures prior to pouring the concrete. Removal of the gapping means leaving gaps between the ends of the forming members and the forms abutting the ends of the forming member enables the ready release of the forming members following setting of the concrete.

Preferably, concrete reinforcing rods supported by stands set across the tops of adjacent spaced apart members and overlying the beam channels hold the rods at a predetermined level above the top of the forming members and substantially parallel thereto. A lower set of concrete reinforcing rods substantially parallel to the beam channels are suspended in the lower portions thereof by ties attached to corresponding respective reinforcing rods supported by the stands.

In another aspect of the invention there is provided apparatus for forming an elevated concrete slab section of a building which includes a plurality of elongated forming members of substantially rectangular cross section. Along opposite side surfaces of and parallel to each forming member proximate the bottom surface thereof are attached a pair of elongated outward protruding shelves. A plurality of elongated beam plates for placement on opposed shelves of adjacent spaced apart forming members in combination with opposed side surfaces of the forming members

define a beam channel. A plurality of elongated bridging plates for placement on top of preselected adjacent spaced apart forming members define a portion of the bottom surface of a concrete slab section which in combination with the top surfaces of the forming members of the beam channels define the form for the bottom of a slab section on which concrete is poured. Reinforcing rods are supported intermediate the beam channels at preselected distances above corresponding associated beam plates. Destructible means are used to separate the ends of said members from adjacent transversely extending forms for a concrete end support structure.

Advantageously, the destructible means are plates of cellular material which are sufficiently soft so that they can be manually separated into small pieces and removed.

The assembly of elongated forming members, beam plates and bridging plates can easily be managed by two workmen without the need for overhead cranes and the like. Moreover, the width of the beam plates and spacers for placement between those forming members not enclosing beam plates can be made to automatically position forming elements so that the distance between the concrete beams formed in the beam channels and the width and depth thereof are as required. Not only is there a considerable reduction in the overall amount of concrete required for an elevated floor section but there is also a corresponding reduction in the

amount of reinforcing rod required since the thinner sections between the concrete beams do not require reinforcement by the rods. Utilizing V-shaped metal stands with notches to support the upper set of reinforcing rods a preselected distance above the tops of the forming members also provides a surface for the support of rails which may be used as screed surfaces for levelling the freshly poured concrete. Finally, there is also a corresponding reduction in the amount of heavy equipment required and in the number of personnel to manage the forms.

In drawings which represent preferred embodiments of the invention;

Figure 1 is a perspective view of the assembled structure for forming a slab section,

Figure 2 is an end view in section along line 2-2 of Figure 1,

Figure 3 is a view of a portion of the forms and assembly for the concrete end support structure,

Figure 4 is a perspective view of the ends of the form used for joining two slab sections,

Figure 5 is an alternative form assembly structure at an end wall structure having beam slots along the top of the end wall,

Figure 6 is a perspective view of a forming member with cardboard end strapping,

Figure 7 is a detailed sectional view showing the cross section of the forming members,

Figure 8 is an alternative form of the forming member also in cross section, and

Figure 9 is a perspective view of a reinforcing rod stand.

In the following discussion words such as top, bottom, upper, lower and horizontal are used in a relative sense only and not in absolute sense. In the various Figures like references numbers indicate like parts.

Figure 1 illustrates the assembled structure used to define a section of a concrete slab. A pair of beams which define an assembly supporting structure are held at a preselected distance above a ground level 11 by a plurality of adjustable supports 12. Traversing the supporting structure are a plurality of parallel spaced apart elongated forming members 14 which are rectangular in cross section. The forming members 14 are constructed of plywood sheets joined by either elongated aluminum extrusions 26 as shown in Figure 7 or by elongated braces 32 as shown in Figure 8. Each forming member 14 includes an outward projecting shelf or ledge 24a, 24b running along the entire length of each side of the forming member 14. A plurality of beam plates 20 are supported by opposed spaced apart shelves 24 of associated forming members 14 the spacing between which is

equal to the width of the beam plate 20. The beam plates 20 in combination with the sides 40, 42 of the forming members 14 define a beam channel 38. Over top of those spaces 39 which do not contain a beam plate 20, there is a bridging plate 22 the side edges of which are supported by the tops 43 of the forming elements 14. The ends of those adjacent, spaced apart forming members 14 which do not enclose beam plates are held apart at a preselected distance by spacers 15. At each end of the assembly illustrated in Figure 1 there are located forms 18 for defining a concrete end support structure. Figure 1 illustrates such a structure as comprising a wall 16 whose top surface is at substantially the same level as the bottom surface of beam channels 38 formed by the two sides 40 and 42 of the spaced apart forming elements 14 and the top surface of beam plate 20. Each of the beam channels 38 communicates with the interior of the forms 18 which form the concrete end support structure (not shown). Rather than a wall 16 as shown in Figure 1 there may be a large concrete beam 56 as shown in Figure 3 supported at regular intervals therealong from the floor 11 by posts (not shown).

As illustrated in Figures 9 and 1 a plurality of disposable metal stands 34 formed by bending sheet metal into a V-shape and forming a notch 36 midway along the bent portion are placed across the beam channel 38 at regular

intervals therealong such that each stand is supported at its ends by respective associated forming members 14. An elongated strip 37 along the outer edge of each wing 35 of the stand 34 is bent so that the two strips 37 on each stand 34 lie in a plane perpendicular to a notional plane bisecting the angle between the wings 35. A small hole 39 is drilled at one corner of each strip 37 the holes being at diagonally opposite corners of the stand 34. The stands 34 are fabricated so that they hold a reinforcing rod 46 at a preselected level above the forming members 14. Further reinforcement is provided by laying mesh or reinforcing bar 62 over top of the upper set of reinforcing rods 46. By laying beams or rails 60 transversely across the upper set of reinforcing rods 46 there is provided a level surface 61 (see Figure 2) for use in screeding the freshly poured concrete. A lower set of reinforcing rods 48 is suspended from the upper set 46 by a plurality of ties or wire hooks 44 which grasp both the upper and lower rods 46 and 48. The weight of the reinforcing rods 46 and 48 is sufficient to prevent any movement of the stands 34 once the structure is assembled.

Figure 2 illustrates a sectional view of the assembly taken along line 2-2 of Figure 1.

As seen in Figure 3 strips of cellular material such as styrofoam 52 are positioned between the ends 50 of each forming member 14 and abutting portions 54 of the forms 18 of the end support structure.

Figure 4 shows a method of joining the ends of two adjacent slab forming assemblies. A platform 70 is supported by a pair of beams 10 which, in turn, are supported by adjustable supports 12. The ends of forming members 14 are held at a desired distance above the platform 70 by blocks 72 which also support the cellular material 52 and portion 54 of the forms for the end structure.

Figure 5 shows an alternative end wall structure which would be used for prefabricated walls 76 in which the top 82 of wall 76 has a plurality of beam notches 78 coinciding with the beam channels 38 of the slab forming assembly. Rather than using cellular material 52, the end 50 of each forming member 14 has fastened with staples 84 around its periphery as shown in detail in Figure 6 a strip of cardboard 74 with approximately a 1 inch overlap which abuts the wall 76 (Figure 5).

The method of forming an elevated slab section includes positioning the pair of beams 10 a preselected distance above the ground level 11 or below a top surface of the concrete slab to be formed by adjusting the adjustable supports 12. With the beams 10 in position the forming

members 14, beam plates 20 and bridging plates 22 are laid transversely to the beams 10 with beam channels 38 formed at regular intervals usually with beam plates 20 alternating with bridging plates 22. Small finishing nails driven through the bridging plates 22 into the forming member 14 may be used to hold the bridging plates 22 in position. Once the latter structure is assembled, reinforcing rods 46 held by notched metal stands 34 are supported over the beam channels 38 by the tops of opposed forming members 14 along the entire length of the channel and extending therebeyond into the area within the forms 18 of the end support structure. The stands are fixed in position by two small finishing nails nailed through holes 39 into the forming members 14. Next a lower set of reinforcing rods 48 are suspended from each of the upper rods 46 by a plurality of hooks 44.

Strips of cellular material 52 such as styrofoam are stapled to portions 54 of the forms 18 so that when in situ each end edge of end 50 of the forming member 14 is covered by a strip of the cellular material 52. The portion 54 of the forms 18 are opened at each beam channel 38 so that the latter communicates with the interior of the forms 18 and so that the reinforcing rods 46 and 48 lying along the beam channel 38 extend within the interior of the forms 18.

Wire mesh or reinforcing rod 62 is laid over top

of the assembled structure as seen in Figures 1 and 2. The upper reinforcing rods 46 are used to support a pair of rails 60 whose top surface is at the desired level of the top surface of the slab section to be formed. The rails 60 are utilized to screed the top surface of concrete which is poured over the structure through the wire mesh. Concrete is also poured at the same time in the forms 18 of the end support structure.

Following setting of the concrete release of the forming members 14 may be achieved by simply removing the cellular material 52 from each end of the forming members 14 thereby leaving a gap and permitting release of the forming members from concrete which contacts the upper surface and in some cases one side surface thereof. The bridging plates 22 and beam plates 20 are also removed. Once completion of a given slab section is achieved, the forming members 14 bridging plates 22 and beam plates 20 can all be easily removed for use on an additional slab section. However, the metal stands 34 are permanently incorporated into the concrete of the slab section.

It is obvious that materials other then wood such as aluminum or fibreglass could be used for the forming members 14 and other methods of fixing the bridging plates 22 to them used such as mating slots and slot receptacles.

Other modifications departures and variations of

the method and apparatus disclosed which do not depart from the spirit of the invention or the scope hereof as defined in the appended claims will be obvious to those skilled in the art.

CLAIMS:

1. A method of forming an elevated concrete slab section of a building, comprising:

(a) assembling a supporting structure at a predetermined distance below a desired level for a top surface of said slab section;

(b) laying a plurality of elongated forming members of substantially rectangular cross section in parallel spaced apart relationship on top of said supporting structure with the ends of the said members extending between transversely extending forms of concrete end supporting structures, said forming members having protruding horizontal shelves along their sides parallel to their bottom surface

(c) laying elongated beam plates on said shelves between preselected ones of said forming members such that a beam plate in combination with opposed sides of said forming members define a beam channel;

(d) laying elongated bridging plates over those spaces between adjacent forming members which do not define beam channels such that the combination of said bridging plates, top surfaces of said forming members and said beam channels define the form for a bottom surface of said

concrete slab section;

(e) pouring concrete over the combination of forming members, bridging plates and beam plates to a preselected level above the tops of said forming members; and

(f) levelling the top surface of the partially poured concrete to form a top slab surface for said slab section.

2. A method as defined in claim 1, further comprising placing gapping means for spacing the ends of said elongated forming members from the forms for the concrete end supporting structure prior to pouring the concrete so that after the concrete sets, the forming members may be released from the concrete adjacent the ends thereof.

3. A method as defined in claim 2, wherein said gapping means is cellular material placed between the ends of said elongated forming members and the forms for the concrete end supporting structure prior to pouring the concrete so that after the concrete sets, the forming members may be released from the concrete adjacent the ends thereof by removal of said cellular material.

4. A method as defined in claim 3, further comprising supporting an upper set of concrete reinforcing rods by longitudinally spaced stands set across the tops of adjacent forming members and overlying the beam channels

said stands for holding the rods at a predetermined level above the top of said forming members intermediate and substantially parallel thereto.

5. A method as defined in claim 4 further comprising suspending a lower set of concrete reinforcing rods substantially parallel to said beam channels and in the lower portion thereof by ties attached to corresponding respective upper reinforcing rods.

6. A method as defined in claim 4 further comprising laying reinforcing mesh over the tops over said upper set of reinforcing rods.

7. A method as defined in claim 5 further comprising supporting a plurality of rails transversely to and on said upper set of rods for providing a level from which to screed the top surface of freshly poured concrete.

8. Apparatus for forming an elevated concrete slab section of a building, comprising:

(a) A plurality of elongated forming members of substantially rectangular cross section;

(b) a pair of elongated outwardly protruding shelves formed along opposite sides surfaces of and parallel to each forming member proximate the bottom surface thereof;

(c) a plurality of elongated beam plates for placement on opposed shelves of adjacent spaced apart forming members for defining, in combination with opposed

side surfaces of said adjacent forming members, a beam channel;

(d) a plurality of elongated bridging plates for placement on top of preselected adjacent spaced apart forming members for defining a portion of the bottom surface of a concrete slab section which, together with the top surface of said members and said beam channels, defines the form for the bottom of the slab section on which concrete is to be poured;

(e) means for supporting reinforcing rods intermediate said beam channels at preselected distances above corresponding associated forming members;

(f) destructible means for separating the ends of said members from adjacent transversely extending forms for a concrete end support structure.

9. Apparatus as defined in claim 8, wherein said destructible means are plates of cellular material which are sufficiently soft to be manually separable into small pieces.

10. Apparatus as defined in claim 9, wherein said cellular material is styrofoam.

11. Apparatus as defined in claim 8, wherein said elongated forming members are each a box having two ends and four sides and closed on at least four of its sides and having a pair of elongated shelves on respective opposite

sides extending along substantially the entire length of the box.

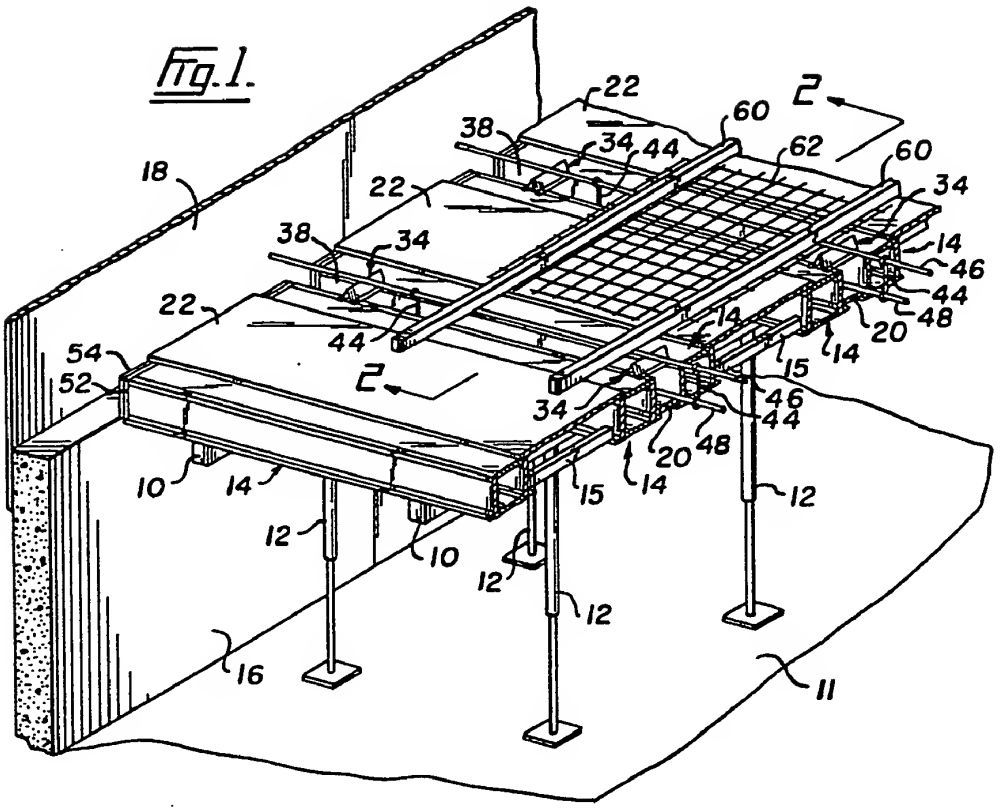
12. Apparatus as defined in claim 11, wherein the sides of said box are wooden.

13. Apparatus as defined in claim 11, wherein said means for supporting reinforcing rods includes a plurality of metal plates each bent into a V-shaped elongated stand and having a notch in the bent edge intermediate its ends for receiving and holding in place relative to the stand a reinforcing rod, said stand being of a length sufficient to straddle the tops of adjacent spaced apart forming members whose opposed side edges in combination with an intermediate beam plate define a concrete beam channel.

14. Apparatus as defined in claim 13, wherein said stands are of a height to support reinforcing rods at a preselected distance below a desired level for a top of a concrete slab such that the reinforcing rods act as supports for rails supported transversely to said rods and are used to screed a top surface of freshly poured concrete.

15. Apparatus as defined in claim 13, wherein said means for supporting reinforcing rods further includes a plurality of hooks for supporting reinforcing rods from those resting on the stands, the hooks of a length such that the lower rods are at a preselected distance above said elongated beam plates.

Fig. 1.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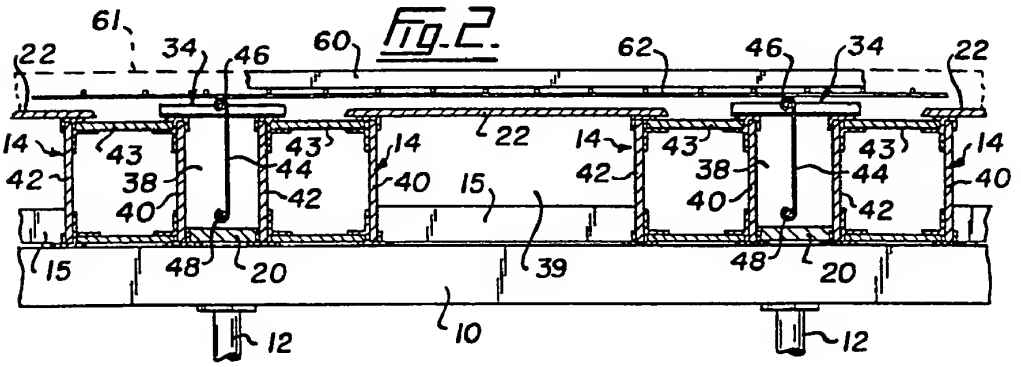
Fig. 2.
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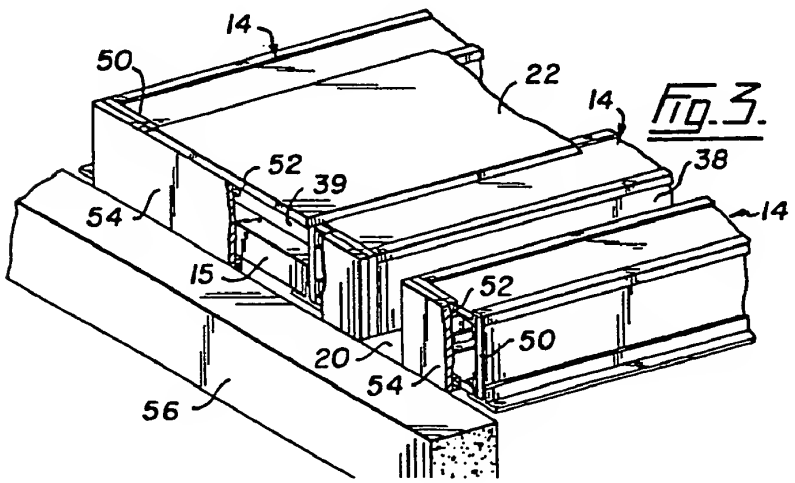
Fig. 3.
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Fig. 4.

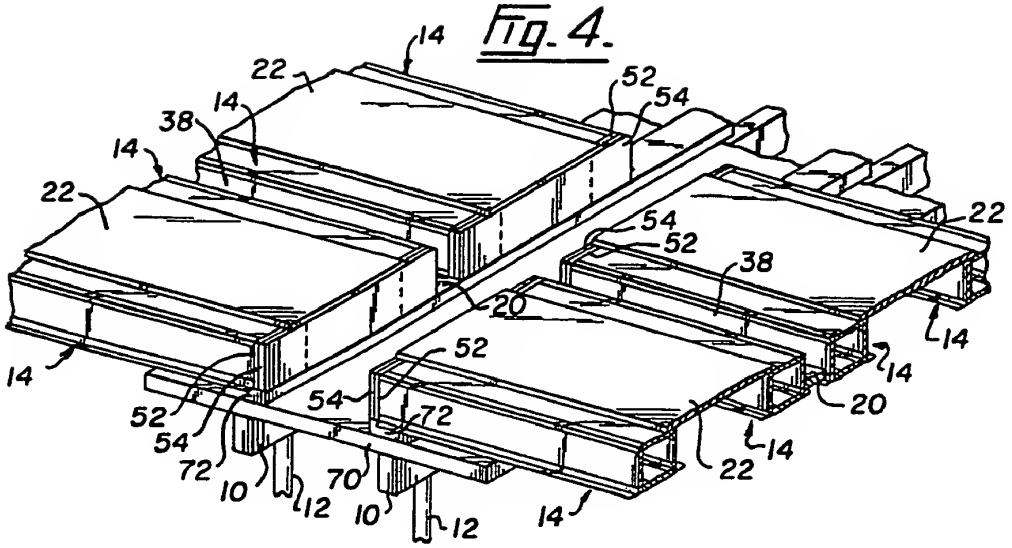


Fig. 5.

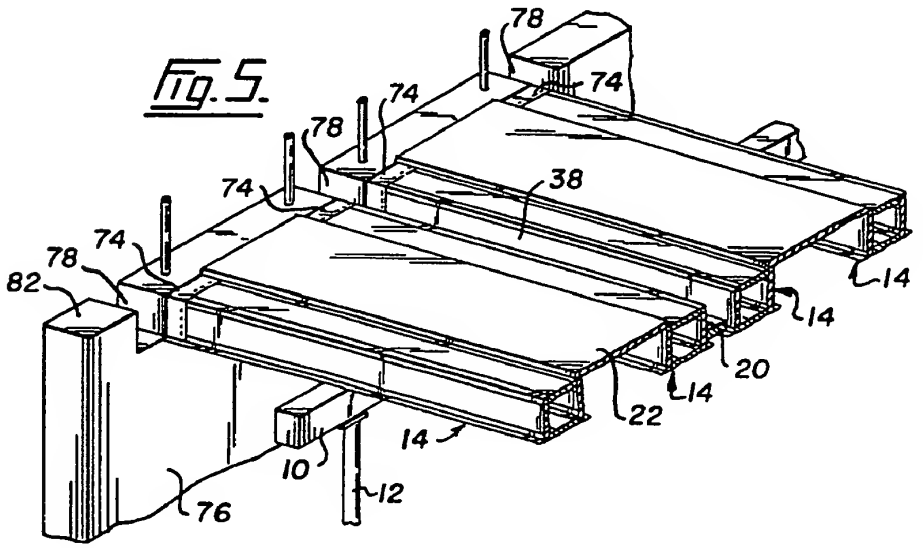
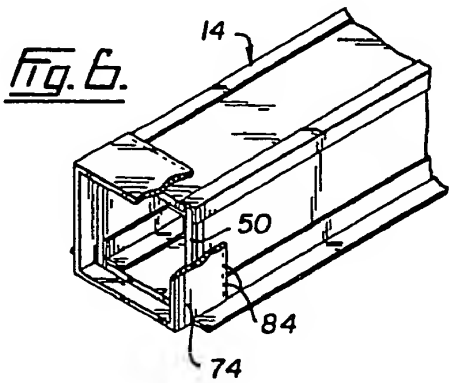


Fig. 6.



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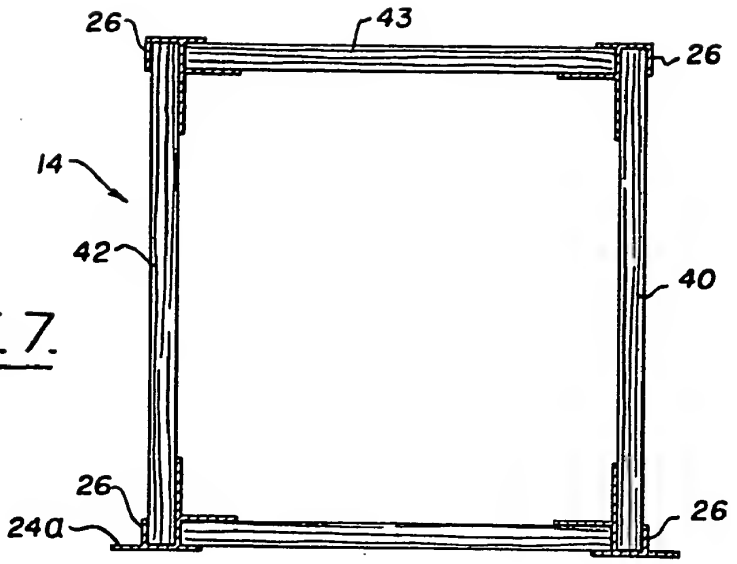

Fig. 7.

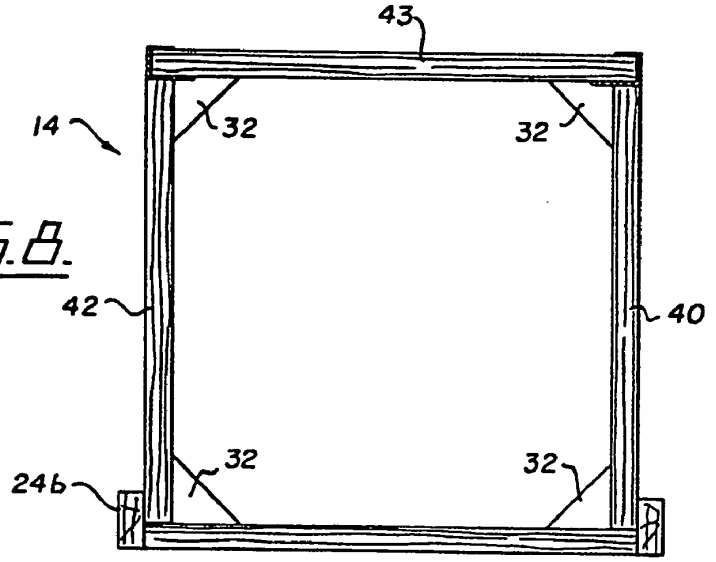

Fig. 8.

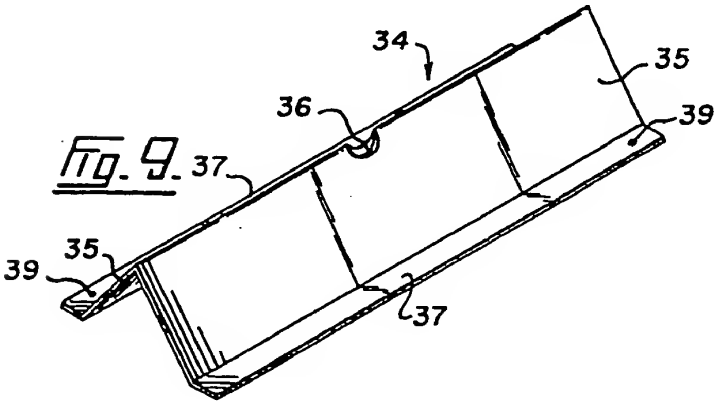

Fig. 9.

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EUROPEAN SEARCH REPORT

Application number
EP 81 30 4528.3

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	GB - A - 1 052 097 (S.A. RHODIUS-DEVILLE) * whole document *	1,8
	GB - A - 237 438 (G.W. STOKES) * fig. 3,4,6 *	1,8,11
	FR - A - 1 315 135 (M.E. BOURGE) * fig. 2,3 *	1,8
	US - A - 1 508 422 (J.A. TAGGART) * page 1, lines 30 to 33; fig. 2,3 *	1,8,11, 12
	GB - A - 1 015 064 (MASONITE CORP.) * whole document *	1,2,8
	DE - U - 7 330 030 (PERFEKTA-BAUSTOFFE GMBH) * page 4, lines 12 to 26; fig. 1,2 *	1-3,8,9
	US - A - 1 964 958 (G.S. NELSON) * page 1, lines 99 to 101; fig. 1 *	8
	US - A - 1 353 373 (E.F. ALLBRIGHT) * page 2, lines 42 to 55; fig. 1,4,5 *	4,13,14

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CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
E 04 G 11/46

TECHNICAL FIELDS SEARCHED (Int. Cl.³)
E 04 G 11/00

CATEGORY OF CITED DOCUMENTS
X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons
&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	06-01-1982	KRABEL

EPO Form 1503.1 06.78

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EUR PEAN SEARCH REPORT

Application number
EP 81 30 4528.3

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	FR - A - 672 769 (A. LEBLANC) * fig. 2,4 *	5,15	
	US - A - 2 206 939 (P. CARILLI) * fig. 4 *	13	
			TECHNICAL FIELDS SEARCHED (Int. Cl.³)